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(71) Applicant: MILLIKEN & COMPANY [US/US]; 920 Milliken Road, Spartanburg, SC 29303 (US).

(72) Inventor: SOLLARS, John, A.; 805 Wheelis Way, La-Grange, GA 30240 (US).

(74) Agent: ALEXANDER, Daniel, R.; P.O. Box 1927, Spartanburg, SC 29304 (US).

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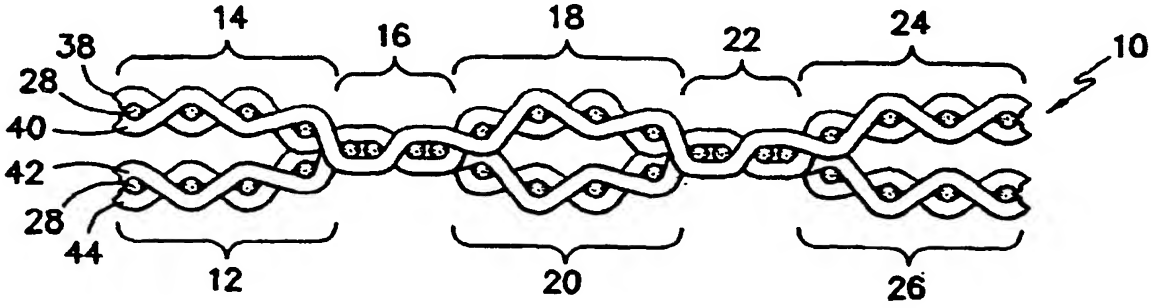
(54) Title: INFLATABLE FABRICS COMPRISING BASKET-WOVEN ATTACHMENT POINTS BETWEEN FABRIC PANELS



(57) Abstract: All-woven inflatable fabrics (10) which comprise areas (14) of two layers and attachment points or "seams" (16) where single layers of fabric are formed. Such single fabric layers are constructed solely through the utilization of basket weave patterns. These specific single fabric layers provide a relatively effective manner of reducing air permeability within the entire fabric article by decreasing the possibility of yarn shifting upon inflation. Alternatively, the presence of at least a second single fabric layer area (22) adjacent to the first (16) and separated by a narrow double fabric layer (18) can further reduce the possibility of yarn shifting in the first single fabric layer. Such a fabric may be utilized in applications where fabric inflation is desired or necessary. In particular, the inventive fabric may be incorporated within an airbag cushion.

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Disclosure

INFLATABLE FABRICS COMPRISING BASKET-WOVEN ATTACHMENT POINTS BETWEEN FABRIC PANELS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application is a continuation of U.S. Patent Application Serial No. 09/406,264, filed September 24, 1999.

Technical Field

The invention relates to all-woven inflatable fabrics which comprise areas of two layers and attachment points or "seams" where single layers of fabric are formed. Such single fabric layers are constructed solely through the utilization of basket weave patterns. These specific single fabric layers provide a relatively effective manner of reducing air permeability within the entire fabric article by decreasing the possibility of yarn shifting upon inflation of the inflatable fabric. Alternatively, the presence of at least a second single fabric layer area adjacent to the first and separated by a narrow double fabric layer can further reduce the possibility of yarn shifting in the first single fabric layer area. Such a fabric may be utilized in numerous and various applications wherein fabric inflation is desired or necessary. In particular, the inventive fabric may be incorporated within an airbag cushion.

Background of the Prior Art

All U.S. patent cited herein are hereby fully incorporated by reference.

Inflatable protective cushions used in passenger vehicles are a component of relatively complex passive restraint systems. The main elements of these systems are: an impact sensing system, an ignition system, a propellant material, an attachment device, a system enclosure, and an inflatable protective cushion. Upon sensing an impact, the propellant is ignited causing an explosive release of gases filing the cushion to a deployed state which can absorb the impact of the forward movement of a body and dissipate its energy by means of rapid venting of the gas. The entire sequence of events occurs within about 30 milliseconds. In the undeployed state, the cushion is stored in or near the steering column, the dashboard, in a door, or in the back of a front seat placing the cushion in close proximity to the person or object it is to protect.

Inflatable cushion systems commonly referred to as air bag systems have been used in the past to protect both the operator of the vehicle and passengers. Systems for the protection of the vehicle operator have typically been mounted in the steering column of the vehicle and have utilized cushion constructions directly deployable towards the driver. These driver-side cushions are typically of a relatively simple configuration in that they function over a fairly small well-defined area between the driver and the steering column. One such configuration is disclosed in U.S. Patent 5,533,755 to Nelsen et al., issued July 9, 1996, the teachings of which are incorporated herein by reference.

Inflatable cushions for use in the protection of passengers against frontal or side impacts must generally have a more complex configuration since the position of a vehicle passenger may not be well defined and greater distance may exist between the passenger and the surface of the vehicle against which that passenger might be thrown in the event of a collision. Prior cushions for use in such environments are disclosed in U.S. Patent 5,520,414 to Bishop; U. S. Patent 5,454,594 to Krickl; U.S. Patent 5,423,273 to Hawthorn et al.; U.S. Patent 5,316,337 to Yamaji et al.; U.S. Patent 5,310,216 to Wehner et al.; U.S. Patent 5,090,729 to Watanabe; U.S. Patent 5,087,071 to Wallner et al.; U.S. Patent 4,944,529 to Backhaus; and U.S. Patent 3,792,873 to Buchner et al.

The majority of commercially used restraint cushions are formed of woven fabric materials utilizing multifilament synthetic yarns of materials such as polyester, nylon 6 or nylon 6,6 polymers. Representative fabrics for such use are disclosed in U.S. Patent 4,921,735 to Bloch; U.S. Patent 5,093,163 to Krummheuer et al.; U.S. Patent 5,110,666 to Menzel et al.; U.S. Patent 5,236,775 to Swoboda et al.; U.S. Patent 5,277,230 to Sollars, Jr.; U.S. Patent 5,356,680 to Krummheuer et al.; U.S. Patent 5,477,890 to Krummheuer et al.; U.S. Patent 5,508,073 to Krummheuer et al.; U.S. Patent 5,503,197 to Bower et al.; and U.S. Patent 5,704,402 to Bowen et al. A two-weave construction airbag cushion is exemplified in U.S. Patent 5,651,395 to Graham et al. but does not discuss the importance of narrow basket-weave single fabric layers.

As will be appreciated, the permeability of an airbag cushion structure is an important factor in determining the rate of inflation and subsequent rapid deflation following the impact event. Different airbag cushions are utilized for different purposes. For instance, some airbag cushions are installed within inflation modules for driver protection within the steering column of an automobile. Others are utilized as protection for front seat passengers and are installed in and around the glove compartment and/or on the dashboard in front of such a passenger seat. Still others have been developed in an effort to protect all passengers during a long-duration impact event, such as, for example, a rollover collision. In those types of crashes, the target airbag cushion must inflate quickly under high pressure (such as between about 10 and 40 psi) and remain inflated at a relatively high pressures in order to provide the greatest degree of protection to such passengers. Furthermore, such long-duration airbag cushions preferably comprise "pillow" formations created through the attachment of at least two different fabrics or fabric ends together and sealed, sewn, or the like, together. Upon inflation the free space between the attachment points inflate as well, thereby producing the desired cushioned "pillow" structures. Such long-duration, "pillowed" structures have been disclosed in the prior art as airbag cushions within U.S. Patent 5,788,270 to Halano. However, in order to provide a suitable, effective airbag fabric and cushion comprising two or more points of attachment between fabrics or fabric ends, there has been a need to improve upon the structural integrity of the seams at such attachment points to prevent unwanted and potentially harmful leakage of gas or air from within the target airbag cushion. The prior art has discussed the development of coatings to place over the sewn seams at such

attachment points in order to seal the potentially loose portions of such seams and/or to keep the individual yarns of the airbag fabrics at the attachment points stationary in order to prevent yarn shifting and thus possible openings for air or gas leakage. However, such coatings are actually supplemental to the seam structures in providing the necessary barrier to air or gas. A strong, effective, efficient weave construction is the primary method of initially producing an effective airbag fabric for incorporation within an airbag cushion.

Previous attempts have been made at producing inflatable fabrics comprising "pillowed" chambers (such as for side curtains, and the like) which have been produced solely through a weaving procedure and which exhibit reduced air permeability within their weave constructions (in other words, fabrics which are not sewn together to form an inflatable structure). For instance, the closest art appears to be U.S. Patent 5,011,183 to Thornton et al. which discloses an inflatable fabric structure comprising at least two different areas of differing fabric layers. Patentees discuss two layers of fabric produced by a plain weave and single layer constructions of a plurality of different weave patterns. The interface between the two different fabric layer areas must exhibit at least three different fabric densities (which are dictated by weave constructions), wherein the two looser constructions (double layer plain weave and single layer basket weave) are separated by a tighter construction (single layer plain weave). Such an overall inflatable fabric structure may possess the necessary air permeability characteristics required for proper functioning within a side curtain airbag cushion (particularly upon coating with a standard airbag coating composition); however, the numerous differences in fabric densities also place

varying pressures upon discrete areas of the fabric (particularly at or near the interface between the differing fabric layer areas) such that yarn shifting will most likely occur during an inflation event which may produce discontinuities in the integrity of the coating which may in turn compromise the long-term air permeability required for certain airbag applications.

Attempts have been made at improving on such a fabric; however these have led to an increase in the number of different fabric density areas on the fabric, rather than reducing such differing densities. For example, a plain weave construction has been utilized within the double layer area, adjacent to a transition weave pattern, which connects with an Oxford weave pattern, and then either a basket-weave or plain weave construction for the remainder of the single layer area on the fabric. Such a complicated scheme is difficult to produce on a weaving apparatus, as an initial problem. Secondly, the utilization of an Oxford weave zone has been utilized in an attempt to prevent the possibility of weaving in a plain pattern (which is highly undesirable due to the difficulty in manufacturing such high density single-layers fabrics from double-layer amounts of yarn). However, if the area of single layer of fabric is not substantially a straight line, and thus must follow a curved structure, the Oxford weave will eventually become a plain weave for at least that area around such a curved seam. In such an instance, the interface between the two differing layers of fabric will be irregular and invariably produce an undesirable and/or irregular number of floats (i.e., yarns which pass either over or under a certain number of perpendicularly oriented yarns; greater than three such oriented yarns would produce difficulties in preventing yarn shifting, as merely one example). As such,

the resultant fabric is itself highly undesirable as a barrier to air permeability, even though coatings may be applied to increase such performance. Thirdly, the individual yarns at the seam between the double and single layer areas, will be placed upon tremendous strain during an inflation event and, as in the Thornton et al. teaching, will most likely result in yarn shifting. With such shifting yarns, the permeability benefits, if any, would, again, most likely be compromised and the produced airbag fabric would not function as required.

To date, there has been no method or fabric structure which has remedied these problems and still can be efficiently woven in a one-step process. A clear need for such an improvement in inflatable fabrics is thus necessary.

Summary of the Invention

In view of the foregoing, it is a general object of the present invention to provide an inflatable all-woven fabric having all-basket-woven seams at the single/double layer interfaces within the fabric. It is a more particular object of the present invention to provide an all-woven inflatable fabric with double layer zones of fabric and single layer zones of fabric (to form "pillowed" chambers) which comprises at most two different fabric densities throughout the entire fabric structure. Also, an object of this invention is for the utilization of such inflatable fabrics as airbag cushions within a vehicle restraint system. The term "vehicle restraint system" is intended to mean both inflatable occupant restraining cushion and the mechanical and chemical components (such as the

inflation means, ignition means, propellant, and the like).

To achieve these and other objects and in accordance with the purpose of the invention, as embodied and broadly described herein, the invention provides an inflatable fabric comprising at least two layers of fabric in certain discrete areas of the fabric and at least one narrow single fabric layer at a discrete area within said fabric, wherein said at least one narrow single fabric layer is formed solely from a basket weave pattern of an even number of yarns, at most 12 yarns in width; preferably, and as well known to the skilled artisan in the fabric weaving industry, the weave structure for said single layer fabrics is a 2 X 2 basket weave pattern at most from 4 to 8 yarns in length. Also, this invention encompasses an inflatable fabric comprising at least two layers of fabric in certain discrete areas of the fabric and at least one single fabric layer at a discrete area within said fabric, wherein the weave diagram for such a fabric does not exhibit more than three consecutive unfilled blocks in any row or column. Furthermore, this invention also concerns an inflatable fabric comprising at least two layers of fabric in certain discrete areas of the fabric and at least one single fabric layer at a discrete area within said fabric, wherein only two separate weave densities are present within the entire fabric structure.

The term "inflatable fabric" is intended to encompass any fabric which is constructed of at least two layers of fabric which can be sealed to form a bag article. The inventive inflatable fabric thus must include double layers of fabric to permit such inflation, as well as single layers of fabric either to act as a seal at the ends of such fabric panels, or to provide "pillowed" chambers within the

target fabric upon inflation. The term "all-woven" as it pertains to the inventive fabric thus requires that the inflatable fabric having double and single layers of fabric be produced solely upon a loom. Any type of loom may be utilized for this purpose, such as water-jet, air-jet, rapier, dobby, and the like. Jacquard weaving and dobby weaving, however, are most preferred.

The constructed fabric may exhibit balanced or unbalanced pick/end counts; the main requirement in the woven construction is that the single layer areas of the inflatable fabric exhibit solely basket-weave patterns. These patterns are made through the arrangement of at least one warp yarn (or weft yarn) configured around the same side of two adjacent weft yarns (or warp yarns) within the weave pattern. The resultant pattern appears as a "basket" upon the arrangement of the same warp (or weft) yarn to the opposite side of the next adjacent weft (or warp) yarn. Such basket weave patterns may include the arrangement of a warp (or weft) yarn around the same side of any even number of weft (or warp) yarns, preferably up to about six at any one time.

The sole utilization of such basket weave patterns in the single layer zones provides a number of heretofore unexplored benefits within inflatable fabric structures. For example, such basket weave patterns permit a constant "seam" width and weave construction over an entire single layer area, even where the area is curved. As noted above, the standard Oxford weaves currently utilized cannot remain as the same weave pattern around curved seams; they become plain weave patterns. Also, such basket weave seam patterns permit the construction of an inflatable fabric having only plain woven

double layer fabric areas and single layer "seams" with no "floats" of greater than three picks within the entire fabric structure. Such a fabric would thus not possess discrete locations where the air permeability is substantially greater than the remaining portions of the fabric. Generally, the prior art (such as Thornton et al., *supra*) produce floats of sometimes as much as six or seven picks at a time. Although available software to the weaving industry permits "filling in" of such floats within weave diagrams, such a procedure takes time and still does not continuously provide a fabric exhibiting substantially balanced air permeability characteristics over the entire structure. The basket-weave formations within the single fabric layers thus must be positioned in the fabric so as to prevent irregularities (large numbers of floats, for example) in the weave construction at the interface between the single and double fabric layers (as described in **FIG. 2**, below). Another benefit such basket weave patterns accord the user is the ability to produce more than one area of single layer fabric (i.e., another "seam" within the fabric) adjacent to the first "seam." Such a second seam provides a manner of dissipating the pressure from or transferring the load upon each individual yarn within both seams. Such a benefit thus reduces the chances of deleterious yarn shifting during an inflation event through the utilization of strictly a woven fabric construction (i.e., not necessarily relying upon the utilization of a coating as well). The previously disclosed or utilized inflatable fabrics having both double and single fabric layer areas have not explored such a possibility in utilizing two basket-weave pattern seams. Furthermore, such a two-seam construction eliminates the need for weaving a large single fabric layer area within the target inflatable fabric. The prior art fabrics which produce "pillowed" chambers for airbag cushions (such as side curtains), have been

formed through the weaving of entire areas of single fabric layers (which are not actually seams themselves). Such a procedure is time-consuming and rather difficult to perform. The inventive inflatable fabric merely requires, this alternative embodiment, at least two very narrow single fabric layer areas (seams) woven into the fabric structure (another preferred embodiment utilizes merely one seam of single layer fabric); the remainder of the fabric located within these two areas may be double layer if desired. Thus, the inventive fabric permits an improved, cost-effective, method of making a "pillowed" inflatable fabric.

The inflatable fabric itself is preferably produced from all-synthetic fibers, such as polyesters and polyamides, although natural fibers may also be utilized in certain circumstances. Preferably, the fabric is constructed of nylon-6,6. The individual yarns utilized within the fabric substrate must generally possess deniers within the range of from about 40 to about 840; preferably from about 100 to about 630.

As noted above, coatings should be applied to the surface as a necessary supplement to the air permeability of the inventive fabric. Since one preferred ultimate use of this inventive fabric is as a side curtain airbag which must maintain a very low degree of air permeability throughout a collision event (such as a rollover where the curtain must protect passengers for an appreciable amount of time), a decrease in permitted air permeability is highly desirable. Any standard coating, such as a silicone, polyurethane, polyamide, polyester, rubber (such as neoprene, for example), and the like, may be utilized for this purpose

and may be applied in any standard method and in any standard amount on the fabric surface.

Additional objects and advantages of the invention will be set forth in part in the description which follows, and in part will be obvious from the description, or may be learned by practice for the invention. It is to be understood that both the foregoing general description and the following detailed description of preferred embodiments are exemplary and explanatory only, and are not to be viewed as in any way restricting the scope of the invention as set forth in the claims.

Brief Description of the Drawings

The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate several potentially preferred embodiments of the invention and together with the description serve to explain the principles of the invention wherein:

FIG. 1 is a cross-sectional view of an inventive all-woven inflatable fabric showing the preferred double and single layer areas including two separate single layer areas.

FIG. 2 is a weave diagram illustrating a potentially preferred repeating pick pattern formed using repeating plain weave and basket weave four-pick arrangements.

Description of the Preferred Embodiment

Turning now to the drawings, in **FIG. 1** there is shown a cross-section of a preferred structure for the double fabric layers **12, 14, 18, 20, 24, 26** and single fabric layers **16, 22** of the inventive inflatable fabric **10**. Weft yarns **28** are present in each of these fabric layer areas **12, 14, 16, 18, 20, 22, 24, 26** over and under which individual warp yarns **38, 40, 42, 44** have been woven. The double fabric layers **12, 14, 18, 20, 24, 26** are woven in plain weave patterns. The single fabric layers **16, 22** are woven in basket weave patterns. Four weft yarns each are configured through each repeating basket weave pattern within this preferred structure; however, anywhere from two to twelve weft yarns may be utilized within these single fabric layer areas (seams) **16, 22**. The intermediate double fabric layer areas **18, 20** comprise each only four weft yarns **28** within plain weave patterns. The number of such intermediate weft yarns **28** between the single fabric layer areas **16, 22** must be in multiples of two to provide the maximum pressure bearing benefits within the two seams **16, 22** and thus the lowest possibility of yarn shifting during inflation at the interfaces of the seams **16, 22** with the double fabric layer areas **12, 14, 24, 26**.

FIG. 2 shows the weave diagram **30** for an inventive fabric which comprises two irregularly shapes concentric circles as the seams. Such a diagram also provides a general explanation as to the necessary selection criteria of placement of basket-weave patterns within the fabric itself. Three different types of patterns are noted on the diagram by different shades. The first **32** indicates the repeated plain weave pattern throughout the double fabric

layers (**12, 14, 18, 20, 24, 26** of **FIG. 1**, for example) which must always initiate at a location in the warp direction of 4X + 1, with X representing the number of pick arrangement within the diagram, and at a location in the fill direction of 4X + 1 (thus, the pick arrangement including the specific two-layer plain-weave-signifying-block **32** begins at the block four spaces below it in both directions). The second **34** indicates an "up-down" basket weave pattern wherein an empty block must exist and always initiate the basket-weave pattern at a location in the warp direction of 4X + 1, with X representing the number of repeating pick arrangements within the diagram, and at a location in the fill direction of 4X + 1, when a seam (such as **16** and **22** in **FIG. 1**) is desired (thus, the pattern including the pertinent signifying "up-down" block **34** includes an empty block within the basket-weave pick arrangement in both the warp and fill directions four spaces below it). The remaining pattern, which is basically a "down-up" basket weave pattern to a single fabric layer (such as **16** and **22** in **FIG. 1**) is indicated by a specifically shaded block **36**. Such a pattern must always initiate at a location in the warp direction of 4X + 1 and fill of 4X + 3, or warp of 4X + 3 and fill of 4X + 1, when a seam is desired. Such a specific arrangement of differing "up-down" basket weave **34** and "down-up" basket weave **36** pattern is necessary to effectuate the continuous and repeated weave construction wherein no more than three floats (i.e., empty blocks) are present simultaneously within the target fabric structure. Furthermore, again, it is believed that there has been no such disclosure or exploration of such a concept within the inflatable fabric art.

While specific embodiments of the invention have been illustrated and

described, it is to be understood that the invention is not limited thereto, since modifications may certainly be made and other embodiments of the principals of this invention will no doubt occur to those skilled in the art. Such modifications include, but are in no way limited to, the ability to produce reverse, mirror, or offset versions of the aforementioned two-pattern combinations within the inventive fabrics. Therefore, it is contemplated by the appended claims to cover any such modifications and other embodiments as incorporate the features of this invention which in the true spirit and scope of the claims hereto.

CLAIMS

What I/we claim is:

1. An inflatable fabric comprising at least two layers of fabric in certain discrete areas of the fabric and at least one narrow single fabric layer at a discrete area within said fabric, wherein said at least one narrow single fabric layer is formed solely from a basket weave pattern of an even number of yarns, at most 12 yarns in width.

2. The fabric of Claim 1 wherein said at least two layers of fabric within said inflatable fabric are formed solely from one type of weave pattern, wherein said weave pattern is not a basket weave pattern.

3. The fabric of Claim 2 wherein the weave pattern of said at least two layers of fabric within said inflatable fabric is a plain weave pattern.

4. The fabric of Claim 1 wherein at least two discrete narrow areas of single fabric layers are present within said inflatable fabric, wherein said at least two single fabric layers are separated by an area of two layers of fabric, and wherein the lengths of each single layer is from 4 to 8 yarns in length.

5. The fabric of Claim 4 wherein said at least two single fabric layer areas are seams through the inflatable fabric which run parallel to each other.

6. The fabric of Claim 4 wherein said at least two single fabric layer areas are constructed solely from basket weave patterns containing at least two yarns per basket pattern and at most four yarns per basket pattern.

7. The fabric of Claim 5 wherein said separator two layers of fabric between said two single layers of fabric comprises an even number of weft yarns.

8. The fabric of Claim 7 wherein said separator two layers of fabric comprises at most 12 weft yarns and at least 2 weft yarns.

9. The fabric of Claim 8 wherein said at least two single fabric layers are constructed solely from two-by-two basket weave patterns and said separator double fabric layer comprises four weft yarns.

10. An inflatable fabric comprising at least two layers of fabric in certain discrete areas of the fabric and at least one single fabric layer at a discrete area within said fabric, wherein the weave diagram for such a fabric does not exhibit more than three consecutive unfilled blocks in any row or column.

11. An inflatable fabric comprising at least two layers of fabric in certain discrete areas of the fabric and at least one single fabric layer at a discrete area within said fabric, wherein only two separate weave densities are present within the entire fabric structure.

12. An inflatable fabric comprising at least two layers of fabric in certain discrete areas of the fabric and at least one narrow single fabric layer at at least two discrete areas within said fabric, wherein said at least one narrow single

fabric layer is formed solely from a basket weave pattern of an even number of yarns, at most 12 yarns in width, wherein at least two discrete narrow areas of single fabric layers are present within said inflatable fabric, wherein said at least two areas of single fabric layers are separated by an area of at least two layers of fabric, and wherein the width of each single layer is from 4 to 8 yarns in length.

13. The fabric of Claim 12 wherein said at least two single fabric layer areas are seams through the inflatable fabric which run parallel to each other.

14. The fabric of Claim 12 wherein said at least two single fabric layer areas are constructed solely from basket weave patterns containing at least two yarns per basket pattern and at most four yarns per basket pattern.

15. The fabric of Claim 12 wherein said separator area of two layers of fabric between said two single layers of fabric comprises an even number of weft yarns.

16. The fabric of Claim 15 wherein said separator area of two layers of fabric comprises at most 12 weft yarns and at least 2 weft yarns.

17. The fabric of Claim 16 wherein said at least two single fabric layers are constructed solely from two-by-two basket weave patterns and said separator area of two layers of fabric comprises four weft yarns.

18. The fabric as recited in Claim 12, wherein said fabric has three different types of patterns, the first pattern is a repeated plain weave pattern throughout at least two layers of fabric which must always initiate at a location in the warp direction of 4X + 1, with X representing the number of pick arrangement a weave diagram, and at a location in the fill direction of 4X + 1, thus, the pick arrangement including the specific two layer plain-weave-signifying-block begins at the block four spaces below it in both directions, the second pattern is an "up-down" basket weave pattern wherein an empty block must exist and always initiate the basket-weave pattern at a location in the warp direction of 4X + 1, with X representing the number of repeating pick arrangements within the diagram, and at a location in the fill direction of 4X + 1, when a single layer fabric is desired, thus, the pattern including the pertinent signifying "up-down" block includes an empty block within the basket-weave pick arrangement in both the warp and fill directions four spaces below it, and the third pattern is basically a "down-up" basket weave pattern to a single fabric layer and must always initiate at a location in the warp direction of 4X + 1 and fill of 4X + 3, or warp of 4X + 3 and fill of 4X + 1, when a seam is desired, such a specific arrangement of differing "up-down" basket weave and "down-up" basket weave pattern is necessary to effectuate the continuous and repeated weave construction wherein no more than three floats or empty blocks are present simultaneously within the target fabric structure.

19. The fabric as recited in Claim 12, wherein weft yarns are present in each of the fabric layer areas over and under which individual warp yarns have been woven, the at least two layer fabric areas are woven in plain weave patterns, the

single fabric layer areas are woven in basket weave patterns, four weft yarns each are configured through each repeating basket weave pattern, however, anywhere from two to twelve weft yarns may be utilized within the single layer fabric areas seams, the intermediate two layer fabric areas comprise each only four weft yarns within plain weave patterns, the number of such intermediate weft yarns between the single layer fabric areas must be in multiples of two to provide the maximum pressure bearing benefits within the two seams with the at least two layer fabric areas.

20. The fabric of Claim 12, wherein each of said at least two discrete narrow areas of single fabric form at least one of a seam and seal.

21. The fabric as recited in Claim 12, wherein at least one of said at least two discrete narrow areas of single fabric form at least one of a non-linear seam and seal.

22. The fabric as recited in Claim 12, wherein said at least two discrete narrow areas of single fabric and said area of at least two layers of fabric form at least one pillowed chamber.

23. The fabric of Claim 12, wherein said fabric is formed on at least one of a jacquard and dobby loom.

24. The fabric as recited in Claim 12, wherein said fabric is sealed to form a bag.

25. In an inflatable all-woven fabric airbag cushion, the improvement comprising at least two layers of fabric in certain discrete areas of the fabric and at least one single fabric layer at a discrete area within said fabric, which forms at least one of a seam and seal, wherein the fabric does not exhibit a float of more than three picks.

26. The airbag cushion of Claim 25, wherein only two separate weave densities are present within the entire fabric structure.

27. The airbag cushion of Claim 25 wherein said at least two layers of fabric within said inflatable fabric are formed solely from one type of weave pattern, wherein said weave pattern is not a basket weave pattern.

28. The airbag cushion of Claim 27 wherein the weave pattern of said at least two layers of fabric within said inflatable fabric is a plain weave pattern.

29. The airbag cushion of Claim 25 wherein a weave diagram having rows and columns of filled and unfilled blocks for the fabric does not exhibit more than three consecutive unfilled blocks in any row or column.

30. The airbag cushion of Claim 25 wherein said fabric is coated.

31. The airbag cushion as recited in Claim 25, wherein said at least one narrow single fabric layer forms an edge seal.

32. The airbag cushion of Claim 25, wherein said at least one single fabric layer area is constructed solely from basket weave patterns containing at least two yarns per basket pattern and at most four yarns per basket pattern.

33. The airbag cushion of Claim 25, wherein said area of at least two layers of fabric comprises an even number of weft yarns.

34. The airbag cushion of Claim 33, wherein said area of at least two layers of fabric comprises at most 12 weft yarns and at least 2 weft yarns.

35. The airbag cushion of Claim 34, wherein said at least one single fabric layer is constructed solely from two-by-two basket weave patterns and said area of at least two layers of fabric comprises four weft yarns.

36. The airbag cushion of Claim 25, wherein the airbag cushion is a side-curtain airbag.

37. The airbag cushion of Claim 25, wherein the airbag cushion has pillow chambers.

38. The airbag cushion of Claim 25, wherein said at least one narrow single fabric layer forms at least one of a non-linear seam and seal.

39. The airbag cushion as recited in Claim 25, wherein said at least one

narrow single fabric layer area and said at least two layer fabric area form at least one pillowed chamber.

40. The airbag cushion as recited in Claim 25, wherein said fabric has three different types of patterns, the first pattern is a repeated plain weave pattern throughout at least two layers of fabric which must always initiate at a location in the warp direction of 4X + 1, with X representing the number of pick arrangement a weave diagram, and at a location in the fill direction of 4X + 1 thus, the pick arrangement including the specific two layer plain-weave-signifying-block begins at the block four spaces below it in both directions, the second pattern is an "up-down" basket weave pattern wherein an empty block must exist and always initiate the basket-weave pattern at a location in the warp direction of 4X + 1, with X representing the number of repeating pick arrangements within the diagram, and at a location in the fill direction of 4X + 1, when a single layer fabric is desired thus, the pattern including the pertinent signifying "up-down" block includes an empty block within the basket-weave pick arrangement in both the warp and fill directions four spaces below it, and the third pattern is basically a "down-up" basket weave pattern to a single fabric layer and must always initiate at a location in the warp direction of 4X + 1 and fill of 4X + 3, or warp of 4X + 3 and fill of 4X + 1, when a seam is desired, such a specific arrangement of differing "up-down" basket weave and "down-up" basket weave pattern is necessary to effectuate the continuous and repeated weave construction wherein no more than three floats or empty blocks are present simultaneously within the target fabric structure.

41. The airbag cushion as recited in Claim 25, wherein weft yarns are present in each of the fabric layer areas over and under which individual warp yarns have been woven, the at least two layer fabric areas are woven in plain weave patterns, the single fabric layer areas are woven in basket weave patterns, four weft yarns each are configured through each repeating basket weave pattern, however, anywhere from two to twelve weft yarns may be utilized within the single layer fabric areas or seams, the intermediate two layer fabric areas comprise each only four weft yarns within plain weave patterns, the number of such intermediate weft yarns between the single layer fabric areas must be in multiples of two to provide the maximum pressure bearing benefits within the two seams with the at least two layer fabric areas.

42. The airbag cushion of Claim 25, wherein at least two discrete narrow areas of single fabric layers are present within said inflatable fabric.

43. The airbag cushion of Claim 42, wherein said at least two single fabric layer areas are seams through the inflatable fabric.

44. The airbag cushion of Claim 25, wherein said fabric is formed on at least one of a jacquard and dobby loom.

45. An inflatable all-woven fabric for use as a pillow chambered inflatable protective cushion in a vehicle passive restraint system such as a side curtain comprising at least two layers of fabric in certain discrete areas of the fabric and at least one narrow single fabric layer at a discrete area within said fabric,

wherein said at least one narrow single fabric layer is formed solely from a two-by-two basket weave pattern of an even number of yarns, at most 12 yarn in width.

46. The fabric of Claim 45 wherein said at least two layers of fabric within said inflatable fabric are formed solely from one type of weave pattern, wherein said weave pattern is not a basket weave pattern.

47. The fabric of Claim 46 wherein the weave pattern of said at least two layers of fabric within said inflatable fabric is a plain weave pattern.

48. The fabric of Claim 45 wherein at least two discrete narrow areas of single fabric layers are present within said inflatable fabric, wherein said at least two single fabric layers are separated by an area of said at least two layers of fabric, and wherein the lengths of each single layer is from 4 to 8 yarns in length.

49. The fabric of Claim 45 wherein said at least two single fabric layer areas are seams through the inflatable fabric.

50. The fabric of Claim 45, wherein said fabric is formed on at least one of a jacquard and dobby loom.

51. The fabric as recited in Claim 45, wherein said fabric is sealed to form a bag.

52. The fabric of Claim 4, wherein said fabric is formed on at least one of a jacquard and dobby loom.

53. In a passive passenger restraint system for a vehicle, the improvement comprising an inflatable protective cushion comprising at least two layers of fabric in certain discrete areas of the fabric and at least one narrow single fabric layer at a discrete area within said fabric, wherein said at least one narrow single fabric layer is formed solely from a basket weave pattern of an even number of yarns, at most 12 yarns in width and forms at least one of a seam and a seal with floats of three picks or less.

54. In an airbag, the improvement comprising an inflatable protective cushion comprising at least two layers of fabric in certain discrete areas of the fabric and at least one narrow single fabric layer at a discrete area within said fabric, wherein said at least one narrow single fabric layer is formed solely from a basket weave pattern of an even number of yarns, at most 12 yarns in width and forms at least one of a seam and a seal with floats of three picks or less.

55. In a side curtain airbag, the improvement comprising an inflatable protective cushion comprising at least two layers of fabric in certain discrete areas of the fabric and at least one narrow single fabric layer at a discrete area within said fabric, wherein said at least one narrow single fabric layer is formed solely from a basket weave pattern of an even number of yarns, at most 12 yarns in width and forms at least one of a seam and a seal with floats of three picks or less.

56. An inflatable fabric adapted for use as an inflatable protective cushion in an occupant restraint system comprising at least two layers of fabric in certain discrete areas of the fabric and at least one narrow single fabric layer at a discrete area within said fabric, wherein said at least one narrow single fabric layer is formed solely from a basket weave pattern of an even number of yarns, at most 12 yarns in width and forms at least one of a non-rectangular seam and seal.

57. In an airbag cushion having a multiple layer portion and a single layer portion, the improvement comprising:

a narrow single fabric layer seam margin, followed by a double fabric layer margin, followed by at least one additional narrow single fabric layer seam margin.

58. The airbag cushion of claim 57, wherein the narrow single fabric layer seam margins are less than or equal to 12 yarns.

59. The airbag cushion of claim 57, wherein the narrow single fabric layer seam margins consist of a 2x2 plain weave pattern of from 2-12 yarns wide.

60. The airbag cushion of claim 57, wherein at least one of said narrow single fabric layer seam margins has substantially no floats of greater than 3 picks.

61. In an airbag cushion formed of a single woven item having multiple layer and single layer portions, the improvement comprising at least one seam comprised of a narrow single fabric layer area between two double layer fabric areas.

62. The airbag cushion of claim 61, wherein the at least one narrow single fabric layer seam is less than or equal to 12 yarns wide.

63. The airbag cushion of claim 61, wherein said at least one narrow single fabric layer seam consists of a 2x2 plain weave pattern of from 2-12 plain weave pattern of from 2-12 yarns wide.

64. The airbag cushion of claim 61, wherein said at least one narrow single fabric layer seam has substantially no floats of greater than 3 picks.

65. The airbag cushion of claim 61, wherein said at least one narrow single fabric layer seam has at least one curved portion.

66. The airbag cushion of claim 61, wherein the woven item comprises a woven fabric having only two weave densities in at least the area of the at least one narrow single fabric layer seam.

67. An inflatable fabric adapted for use as an inflatable protective cushion in an occupant restraint system comprising at least two layers of fabric in certain discrete areas of the fabric and at least one narrow single fabric layer at a

discrete area within said fabric, wherein said at least one narrow single fabric layer is formed solely from a basket weave pattern of an even number of yarns, at most 12 yarns in width and forms at lease one of a seam and a seal with floats of three picks or less.

68. The fabric of Claim 67 wherein said at least two layers of fabric within said inflatable fabric are formed solely from one type of weave pattern, wherein said weave pattern is not a basket weave pattern.

69. The fabric of Claim 68 wherein the weave pattern of said at least two layers of fabric within said inflatable fabric is a plain weave pattern.

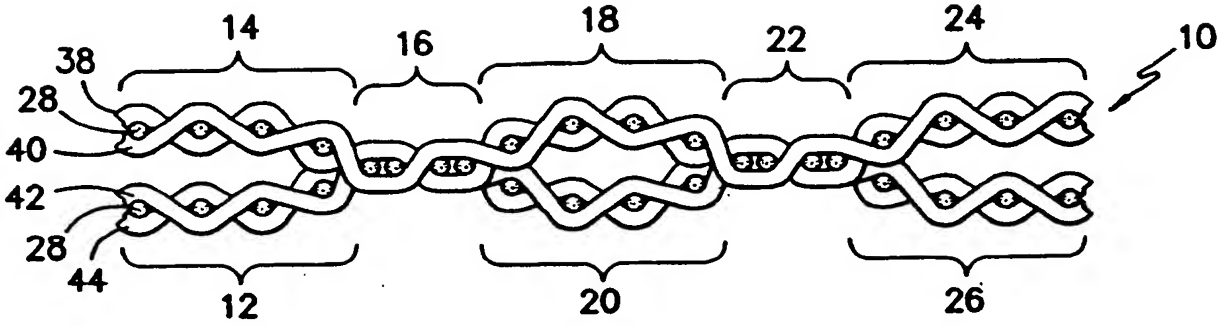

FIG. —1—

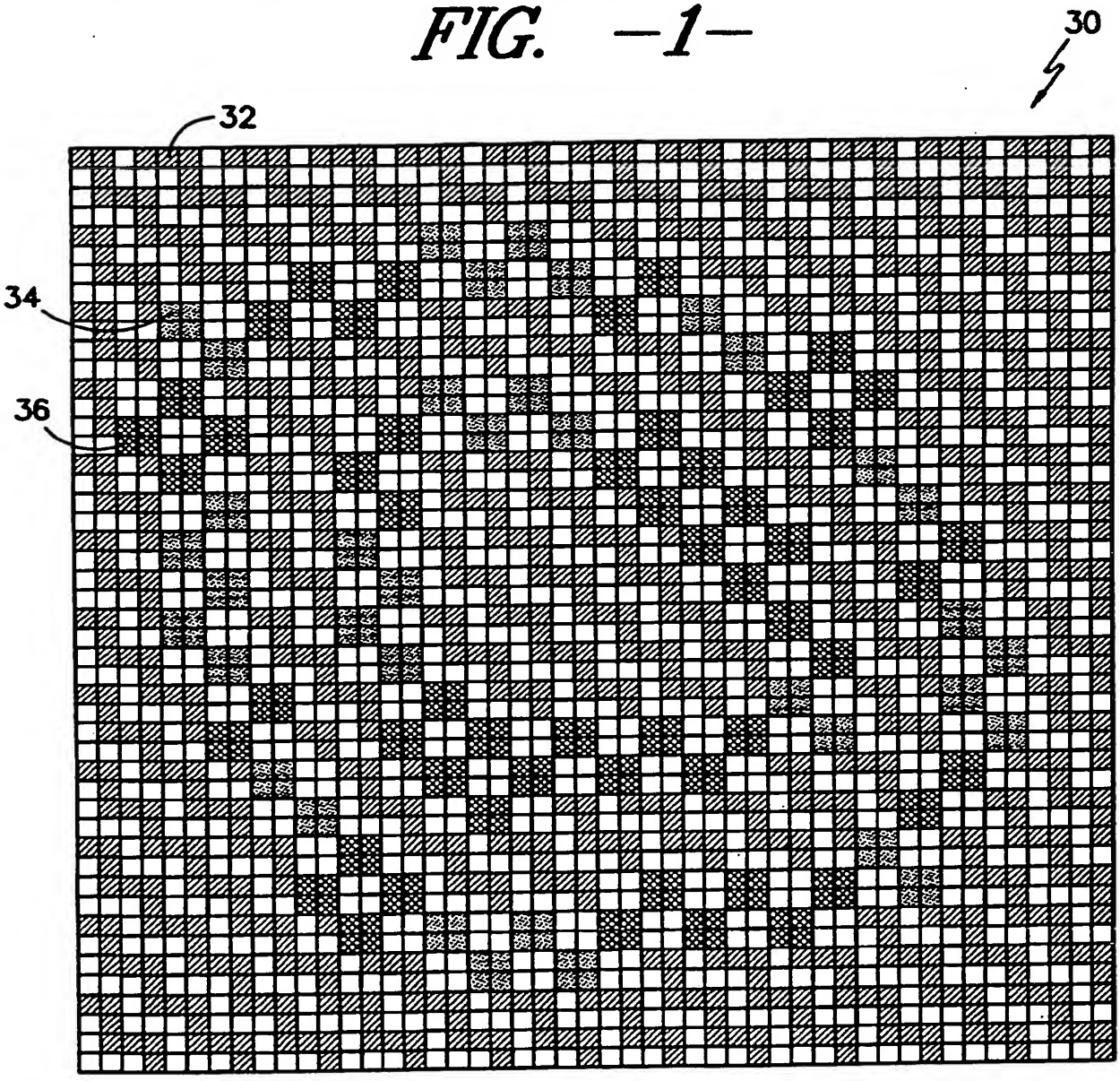

FIG. —2—

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/26286

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :DO3D 1/02, 11/02
US CL :139/389,384R,410,387R; 442/203; 428/101,166; 280/743.1
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 139/389, 384R, 410, 387R; 442/203; 428/166,101; 280/743.1

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 4,668,545 A (LOWE) 26 May 1987, col. 5, lines 16-19.	1-3,11,23
X	US 3,294,605 A (FISCHER) 27 December 1966, entire document.	10,11,25-31,57,61
X	US 1,423,524 A (HILL et al) 25 July 1922, entire document.	1,3,10,11, 23

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 01 DECEMBER 2000	Date of mailing of the international search report 29 DEC 2000
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3230	Authorized officer ANDY FALIK Telephone No. (703) 308-1283

Form PCT/ISA/210 (second sheet) (July 1998) ★

☒ FOR

Patent Abstracts of Japan

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APPLICANT : TOYOBO CO LTD;

INVENTOR : MATSUI MARIKO;

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TITLE : HOLLOW WEAVE AIRBAG FOR SIDE IMPACT

ABSTRACT : PROBLEM TO BE SOLVED: To provide a hollow weave airbag for side impact capable of solving the problem with the conventional airbag of hollow weave for side impact, regarding air leakage in particular, from the boundary part of a bag part to be inflated and a part which is not inflated when the airbag is operated.

SOLUTION: This hollow weave airbag for side impact is formed of an airbag base cloth of hollow weave in which a plurality of cloths are joined with each other in a hollow weave, and has a single-ply part (part B) of the wave structure different from a part (part A) not inflated as a bag body when the airbag is operated on the boundary part of the bag part (multi-ply cloth part) and the part (part A) not inflated as the bag body when the airbag is operated.

P869-EP

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(51)Int.Cl.[7]	識別記号	ＦＩ		テーマコード（参考）
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Ｄ０３Ｃ	3/20	Ｄ０３Ｃ	3/20	４Ｌ０４８
Ｄ０３Ｄ	1/02	Ｄ０３Ｄ	1/02	４Ｌ０５０
	47/28		47/28	

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(71)出願人　000003160
東洋紡績株式会社
大阪府大阪市北区堂島浜２丁目２番８号
(72)発明者　松井　まり子
滋賀県大津市堅田２丁目１番１号　東洋紡績株式会社総合研究所内

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CC25 CC27 EE20
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EA01 EB05
4L050 AA15 AA16 CA19 CA20

(54)【発明の名称】　側面衝突用袋織エアバッグ

(57)【要約】
【課題】本発明の側面衝突用袋織エアバッグは、従来の側面衝突用袋織エアバッグの問題点、特に内圧保持性能の向上に着目し、エアバッグ作動時に膨張しない部分－膨張する袋部の境界部からのエアー漏れに関する問題点を解決する側面衝突用袋織エアバッグを提供することを目的とする。
【解決手段】複数枚の布帛を袋織りにより結合させた袋織エアバッグ基布からなるエアバッグであり、袋部（多重布部）とエアバッグ作動時に袋体として膨張しない部分（A部）との境界部に、該エアバッグ作動時に袋体として膨張しない部分（A部）とは異なる織組織の接結1重部（B部）を有することを特徴とする側面衝突用袋織エアバッグ。

【特許請求の範囲】
【請求項１】　複数枚の布帛を袋織りにより結合させた袋織エアバッグ基布からなるエアバッグであり、袋部（多重布部）とエアバッグ作動時に袋体として膨張しない部分（A部）との境界部に、該エアバッグ作動時に袋体として膨張しない部分（A部）とは異なる織組織の接結1重部（B部）を有することを特徴とする側面衝突用袋織エアバッグ。
【請求項２】　接結1重部（B部）が、経糸および／または緯糸を1～20本有しており、挿入した糸と垂直に交わる糸は織密度に合わせて組織変化されている請求項1記載の側面衝突用袋織エアバッグ。
【請求項３】　接結１重部（B部）の組織の構成が、経糸および／または緯糸が、組織図上、袋部からみて1本毎交互に上下に反転した構成を少なくとも1列以上取る請求項１記載の側面衝突用袋織りエアバッグ。
【請求項４】　接結１重部（B部）の組織の構成が、経糸および／または緯糸が、組織図上、A部からみて1本毎交互に上下に反転した構成を少なくとも1列以上有する請求項1記載の側面衝突用袋織エアバッグ。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は自動車用安全装置の一つであるエアバッグに関するものであり、輸送車両における搭乗者を側面保護するために特に有益なエアバッグに関するものである。
【０００２】
【従来の技術】近年、自動車安全部品の一つとして、エアバッグは乗員の安全意識の向上に伴い、急速に装着率が向上している。エアバッグは自動車の衝突事故の際、衝撃をセンサーが感知し、インフレーターから高温、高圧のガスを発生させ、このガスによってエアバッグを急激に展開させ、乗員保護に役立つものである。
【０００３】従来、エアバッグには運転席用、助手席用の正面からの衝突時に乗員を保護するものが装着されてきたが、最近では側部からの衝突にも対応できるエアバッグが開発されてきた。
【０００４】運転席用、助手席用のエアバッグには従来2枚のエアバッグ基布を縫製することによって、作製されている。しかし、最近エアバッグの性能向上および製造コストの削減から製織段階でバッグを形成することが出来る袋織り技術が注目されてきた。
【０００５】また、側面保護用エアバッグは、自動車のロールオーバーを想定している場合が多く、運転席用、助手席用のエアバッグとは異なり、展開後に内圧保持時間を数秒から10秒程度確保する必要があるとされている。それによって車両がロールオーバー中にも乗員の頭部が保護できるように設計されている。よって、織物本体からのガス漏れを防がなければならず、縫製品では縫い目からの空気漏れがあるため実用的ではない。現状は袋織エアバッグ基布に表面コーティングしていることが通常である。
【０００６】
【発明が解決しようとする課題】ところで、運転席用および助手席用袋織エアバッグの場合、数秒から10秒程度の内圧保持が不必要なため、通常軽量、コンパクト化を目的としてノンコート布が用いられている。そのため、低通気性の高密度織物が必要とされている。また、運転席用および助手席用および側面保護用のどの袋織エアバッグも、展開した際、袋体として膨張しない部分と膨張する袋部の境界部分の目ずれからのエアー漏れやインフレーターからの残さの飛び出しが大きな問題となっており、この問題を解決するため高密度織物が必要とされている。
【０００７】しかも、現段階においては、側面衝突用袋織エアバッグ基布の場合、自動車の横転を想定していることが多く、バッグの内圧保持性能を向上させるため、袋織エアバッグ基布に表面コーティングしたエアバッグを使用している。しかし、現状では自動車の横転に耐えうる内圧保持性能を満たすことが出来ていない。
【０００８】特開平4－193646号公報において、袋織エアバッグの接結一重組織を内側、外側の2つにわけ経糸・緯糸の拘束度の異なる織組織を当てはめることを提案しているが、内外における拘束度の差の規定は無く、エアバッグ展開時に求められる内圧保持性能を十分に得られるだけの提案となっていない。
【０００９】そのため、本発明の側面衝突用袋織エアバッグは、従来の側面衝突用袋織エアバッグの問題点、特に内圧保持性能の向上に着目し、エアバッグ作動時に膨張しない部分－膨張する袋部の境界部からのエアー漏れに関する問題点を解決する側面衝突用袋織エアバッグを提供することを目的とする。
【００１０】
【課題を解決するための手段】上記課題を達成するための手段、即ち本発明の第１は、複数枚の布帛を袋織りにより結合させた袋織エアバッグ基布からなるエアバッグであり、袋部（多重布部）とエアバッグ作動時に袋体として膨張しない部分（A部）との境界部に、該エアバッグ作動時に袋体として膨張しない部分（A部）とは異なる織組織の接結1重部（B部）を有することを特徴とする側面衝突用袋織エアバッグであり、
【００１１】その第２は、接結1重部（B部）が、経糸および／または緯糸を1～20本有しており、挿入した糸と垂直に交わる糸は織密度に合わせて組織変化されている請求項1記載の側面衝突用袋織エアバッグであり、
【００１２】その第３は、接結１重部（B部）の組織の構成が、経糸および／または緯糸が、組織図上、袋部からみて1本毎交互に上下に反転した構成を少なくとも1列以上有する請求項１記載の側面衝突用袋織りエアバッグであり、

【００１３】その第4は、接結１重部（B部）の組織の構成が、経糸および／または緯糸が、組織図上、A部からみて1本毎交互に上下に反転した構成を少なくとも1列以上取る請求項1記載の側面衝突用袋織エアバッグである。

【００１４】

【発明の実施の形態】本発明の袋織エアバッグ基布を構成する原糸は、特に素材を限定するものではないが、特にナイロン66、ナイロン6、ナイロン46、ナイロン12などの脂肪族ポリアミド繊維、アラミド繊維のような芳香族ポリアミド繊維、ポリエチレンテレフタレートやポリブチレンテレフタレートなどのホモポリエステルが使用される。他には全芳香族ポリエステル、超高分子量ポリエチレン繊維、PPS繊維、ポリエーテルケトン繊維などが挙げられる。ただし、経済性を勘案するとポリエステル繊維、ポリアミド繊維（ナイロン66、ナイロン6、ナイロン46）が特に好ましい。また、これらの合成繊維には原糸製造工程や後加工工程での工程通過性を向上させるために、各種添加剤を含有しても何ら問題はない。例えば、酸化防止剤、熱安定剤、平滑剤、帯電防止剤、増粘剤、難燃剤などである。

【００１５】また、通気度低下や目ずれ防止のためのコート剤としては特に限定するものではなく、クロロプレン、クロルスルフォン化オレフィン、シリコーンなどの合成ゴムを塗付またはゴム状のものを接着剤を介してラミネートしても良いし、接着剤を介さずそのままラミネートすることも可能である。また、エアバッグとして性能を満たせば、コーティングやラミネートを施さなくてもノンコート基布で構わないし、ノンコート基布に後加工を施しても構わない。

【００１６】また、製織の際使用される織機についても特に限定はなく、例えばウォータージェットルーム、エアジェットルーム、レピアルーム、プロジェクタイルルームなどが使用される。しかし、織生産性、経糸へのダメージ、糸汚れなどを考慮するとウォータージェットルーム、エアジェットルームが特に好ましい。

【００１７】また、袋織りの柄を決定する際には、ジャカード装置やドビー装置が用いられる。特に複雑な柄出しをするためには、ジャカード装置（電子式、機械式）が必要となり、更に生産性、柄変更の容易さより電子式ジャカード装置が好ましい。

【００１８】以下、本発明の側面衝突用袋織エアバッグの好ましい例を添付図面を参照して詳述する。また、図1は、一般的な側面衝突用袋織エアバッグの一例である。

【００１９】図2の例は、今回使用した袋織エアバッグの模式図である。形状等の因子を省くため、インフレータ取付け口やバッグの複雑な形状は取り入れず簡単化した図面とした。1が袋織り部（多重布部）、2が接結1重部（B部）、3がエアバッグ作動時に膨張しない部分（A部）である。ここで、1の袋織り組織は今回の例の中では2重織の袋を形成しているため、図3に示す組織図は2重布織の一例であり、実際は、これ以外の袋組織を使用しても構わない。

【００２０】図3は、袋組織（2重布織）の組織図例である。

【００２１】図4は、エアバッグ作動時に膨張しない部分（A部、図2-3）の一例であり、これらの組織以外にも境界部（接結1重部B）に入る組織以外であればどのような組織であっても構わない。

【００２２】図2-2の接結1重部（B部）は袋部との境界部に当たり、境界面からみて垂直方向の糸が、組織図上、袋部の最終目と上下が逆転した組織を交互に入れた構成、すなわち、組織図上で袋組織最終目の上下逆転の組織、その次の列にはその前列の逆転の組織、というように順に境界面と垂直方向の糸が上下に一本ずつ交差することが望ましい。

【００２３】かつ／もしくは、図2-2の接結1重部（B部）は袋部との境界部にあたり、境界面からみて垂直方向の糸が、組織図上、A部の最終目と上下が逆転した組織を交互に入れた構成、すなわち、組織図上でエアバッグ作動時に膨張しない部分（A部）の織組織最終目の上下逆転の組織、その次の列にはその前列の逆転の組織、というように順に境界面と垂直方向の糸が上下に一本ずつ交差することが望ましい。

【００２４】この接結1重部（B部）は、経糸かつ／もしくは緯糸を1本～20本有し、挿入した糸と垂直に交わる糸は織密度に合わせて可変することが好ましいが、経糸テンションや経糸のつり等を含むバッグの品位を考慮すると、より好ましくは、1～10本、更に好ましくは、1～5本を挿入し、挿入した糸と垂直に交わる糸は織密度に合わせて可変することが好ましい。

【００２５】

【実施例】以下に実施例をあげて、本発明をさらに詳述する。以下に示す実施例及び比較例における評価は、次の方法で行い、表示した。

【００２６】目開き量：目開き量の測定は、JIS-L1096-8.21.1に準拠して行った。すなわち、袋部（図2－1）とエアバッグ作動時に膨張しない部分（A部、図2-3）の境界である接結1重部（B部、図2-2）を含むサンプルを切り出し、引張試験機で次の条件で引張り、その時の目開き量を測定する。

【００２７】1）接結1重部（B部）が引張方向に対し直角になるように幅3cm、チャック間長さ15cmに設定できるようにサンプルを切り出し（図2の点線a、b）、接結1重部（B部）がチャック間長さ方向の中央になるように設定する。

【００２８】2）引張試験機を用い、引張速度5cm／minで荷重294N時に引張を停止し、その時の織目が最大に開いた箇所の両端の距離をサンプル引張状態のままノギ

ス、メジャーを使用して測定する。

【００２９】3）経、緯各々5回測定し、合計10回の平均値で目開き量値とする。

【００３０】通気度：高圧通気度測定器を用い、サンプル布にかかる差圧を50kPaとし、差圧50kPa下でのサンプル布からの流量（単位：l/cm2/min）を計測する。測定面が直径10cmの円であるため、サンプル布は接結1重部（B部）のある方向を縦とした場合、縦方向15cm、横方向（袋部分のみで）7.5cmに切り出し（図2の点線c、d）、接結1重部（B部）を中心にして、袋部部分を開き、サンプル布とし測定面に設置する。経、緯各々5回測定し、合計10回の平均値で通気度値とする。

【００３１】バッグの品位：加工まで仕上がった側面衝突用袋織エアバッグの欠点、経糸のつりを考慮して、評価を、◎：大変良好、○：良好、△：普通、×：悪い、で印付けしている。

【００３２】

【実施例１】経、緯糸に350dtex/108fのナイロン66フィラメント原糸を用い、エアージェットルームと電子ジャカード装置を用いて平織にて図2-1部を2重袋部で経60本/2.54cm、緯60本/2.54cmになるように袋織りにて製織後、沸水収縮工程を通過させ、引き続き乾燥、セット工程を経て加工反を作成した。この試料の図2－2の境界部には、袋部（二重部）の終り目と上下逆転の組織を1列挿入した。この時の図2-2部の組織図例を図5に示す。

【００３３】

【実施例２】経、緯糸に350dtex/108fのナイロン66フィラメント原糸を用い、エアージェットルームと電子ジャカード装置を用いて平織にて図2-1部を2重袋部で経60本/2.54cm、緯60本/2.54cmになるように袋織りにて製織後、沸水収縮工程を通過させ、引き続き乾燥、セット工程を経て加工反を作成した。この試料の図2－2の境界部には、エアバッグ作動時に膨張しない部分（A部）の終り目と上下逆転の組織を1列挿入した。この時の図2-2部の組織図例を図6に示す。

【００３４】

【実施例３】経、緯糸に350dtex/108fのナイロン66フィラメント原糸を用い、エアージェットルームと電子ジャカード装置を用いて平織にて図2-1部を2重袋部で経60本/2.54cm、緯60本/2.54cmになるように袋織りにて製織後、沸水収縮工程を通過させ、引き続き乾燥、セット工程を経て加工反を作成した。この試料の図2－2の境界部には、エアバッグ作動時に膨張しない部分（A部）の終り目と上下逆転の組織を交互に7列挿入した。この時の図2-2部の組織図例を図7に示す。

【００３５】

【実施例４】経、緯糸に350dtex/108fのナイロン66フィラメント原糸を用い、エアージェットルームと電子ジャカード装置を用いて平織にて図2-1部を2重袋部で経60本/2.54cm、緯60本/2.54cmになるように袋織りにて製織後、沸水収縮工程を通過させ、引き続き乾燥、セット工程を経て加工反を作成した。この試料の図2－2の境界部には、袋部（2重部）の終り目と上下逆転の組織を交互に16列挿入した。この時の図2-2部の組織図例を図8に示す。

【００３６】

【比較例１】経、緯糸に350dtex/108fのナイロン66フィラメント原糸を用い、エアージェットルームと電子ジャカード装置を用いて平織にて図2-1部を2重袋部で経60本/2.54cm、緯60本/2.54cmになるように袋織りにて製織後、沸水収縮工程を通過させ、引き続き乾燥、セット工程を経て加工反を作成した。この試料には、図2－2の境界部を作成せず、袋部から直接エアバッグ作動時に膨張しない部分（A部、図2-3）へつながる組織とした。この時の図2-2部の組織図例を図9に示す。

【００３７】

【比較例２】経、緯糸に350dtex/108fのナイロン66フィラメント原糸を用い、エアージェットルームと電子ジャカード装置を用いて平織にて図2-1部を2重袋部で経60本/2.54cm、緯60本/2.54cmになるように袋織りにて製織後、沸水収縮工程を通過させ、引き続き乾燥、セット工程を経て加工反を作成した。この試料の図2－2の境界部には、袋部（2重部）の終り目と上下逆転の組織を交互に24列挿入した。この時の図2-2部の組織図例を図10に示す。

【００３８】

【比較例３】経、緯糸に350dtex/108fのナイロン66フィラメント原糸を用い、エアージェットルームと電子ジャカード装置を用いて平織にて図2-1部を2重袋部で経60本/2.54cm、緯60本/2.54cmになるように袋織りにて製織後、沸水収縮工程を通過させ、引き続き乾燥、セット工程を経て加工反を作成した。この試料の図2－2の境界部には、1列の平織組織を挿入した。この時の図2-2部の組織図例を図11に示す。

【００３９】

【比較例４】経、緯糸に350dtex/108fのナイロン66フィラメント原糸を用い、エアージェットルームと電子ジャカード装置を用いて平織にて図2-1部を2重袋部で経60本/2.54cm、緯60本/2.54cmになるように袋織りにて製織後、沸水収縮工程を通過させ、引き続き乾燥、セット工程を経て加工反を作成した。この試料の図2－2の境界部には、特開平4－193646号公報の実施例1に使用されている2×2のバスケットを1列（糸本数4本）挿入した。この時の図2-2部の組織図例を図12に示す。

【００４０】実施例、比較例について、その特性を評価した結果を表1に示す。

【００４１】

【表１】

	実施例1	実施例2	実施例3	実施例4
目開き量 (mm)	2.5	2.4	2.4	2.5
通気量 (l/cm2/min)	4.4	4.0	4.0	4.4
バッグの品位	◎	◎	○	○
	比較例1	比較例2	比較例3	比較例4
目開き量 (mm)	3.7	2.5	3.3	3.1
通気量 (l/cm2/min)	6.0	4.4	5.8	5.6
バッグの品位	◎	×	△	○

【００４２】表1からも明らかなように、実施例1、2、3、4の場合は、目開き量も小さく、かつ通気量も低いことから、側面衝突用エアバッグとして展開した際、袋体として膨張しない部分（A部）－膨張する袋部の境界部である接結1重部（B部）からのエアー漏れを減少できることがわかる。

【００４３】また、実施例1、2においては、A部－袋部の境界部に入る経糸かつ／もしくは緯糸本数が少ないため、バッグの厚み均一性が得られ、得られるバッグの品位は大変良好である。

【００４４】実施例3、4の場合、A部－袋部の境界部に入る経糸かつ／もしくは緯糸の本数が実施例1、2と比較して多くなるので、バッグの厚みの均一性が多少落ちる。しかし、この本数レベルであれば境界部によりシワ等の欠点を増やすような悪さはなく、バッグの品位は良好である。

【００４５】比較例1の場合、境界部が存在しないため、バッグの厚み均一性は得られ、得られるバッグ品位は大変良好であるが、A部－袋部が直接つながっているため、その部分の目開き量が大きくなり、よって、通気量も高くなる。そのため、エアバッグとして展開した際に、A部－袋部との境目からエアー漏れが激しく起こし、エアバッグとしての性能を発揮できない。

【００４６】また、比較例2の場合、A部－袋部の境界部に経糸かつ／もしくは緯糸が必要以上に挿入されているため、境界部の目開き量、通気量の値は良いが、バッグの厚み均一性が得られず、厚みムラからシワを発生させる原因となり、得られるバッグの品位が著しく悪くなる。

【００４７】比較例3の場合、A部－袋部の境界部にのみ平織組織を挿入するためその部分の経糸かつ／もしくは緯糸の織縮みが激しくなり、糸のツリが発生し、バッグの品位を悪くする原因となる。また、境界部分で浮糸が発生する場合があり、バッグの品位を落すと共に、その部分で目開きが起り、通気量が高くなるため、バッグとして展開した際に、その部分からエア漏れが発生し、エアバッグとしての性能を十分に発揮できない。

【００４８】比較例4の場合、特開平4－193646号公報の実施例に記載してある通り、袋体として膨張しない部分（A部）よりは拘束度の高い組織を接結1重部（B部）に挿入しているが、この程度の拘束度の差ではバッグが展開した際の目開き量やその部分からのエアー漏れには耐えられないという結果が今回出ている。つまり、この組織は、袋部との境界面に存在する経糸かつ／もしくは緯糸が、組織図上、袋部からみて1本毎交互に上下に反転した構成を少なくとも1列以上取り、かつ／もしくは、袋部との境界面に存在する経糸かつ／もしくは緯糸が組織図上、エアバッグ作動時に膨張しない部分（A部）からみて1本毎交互に上下に反転した構成を少なくとも1列以上取るようになっていないため、A部－袋部の境界部で発生する浮糸等の問題点を解決できず、境界部目開き量が大きくなり、最終的に得られるバッグの性能は低いものとなる。

【００４９】

【発明の効果】本発明の側面衝突用袋織エアバッグは、エアバッグ作動時に袋体として膨張しない部分と膨張する袋部との境界部に特別な組織帯を挿入することによって、エアバッグ膨張時においても、境界部の目ずれが低減し、インフレーターからのエアー洩れを防ぐことができ、最終的にはエアバッグの内圧保持性能を向上できる。

【図面の簡単な説明】

【図１】一般的な側面衝突用袋織エアバッグの一例。

【図２】実施例、比較例に使用した側面衝突用袋織りエアバッグの１例を示す平面図。

【図３】実施例、比較例に使用した2重袋織部の組織図。

【図４】実施例、比較例に使用したエアバッグ作動時に膨張しない部分（A部）の組織図。

【図５】実施例1に使用した接結1重部（B部）の組織図。

【図６】実施例2に使用した接結1重部（B部）の組織図。

【図７】実施例3に使用した接結1重部（B部）の組織図。

【図８】実施例4に使用した接結1重部（B部）の組織図。

【図９】比較例1に使用した接結1重部（B部）の組織図。

【図１０】比較例2に使用した接結1重部（B部）の組織図。

【図１１】比較例3に使用した接結1重部（B部）の組織図。

【図１２】比較例4に使用した接結1重部（B部）の組織

図。

【符号の説明】

1：袋部

2：接結1重部B部（袋部－A部の境界部）

3：エアバッグ作動時に膨張しない部分（A部）

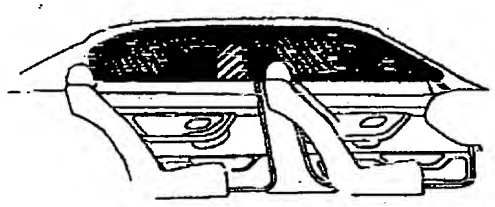
a：目開き量サンプル切り出し例

b：目開き量サンプル切り出し例

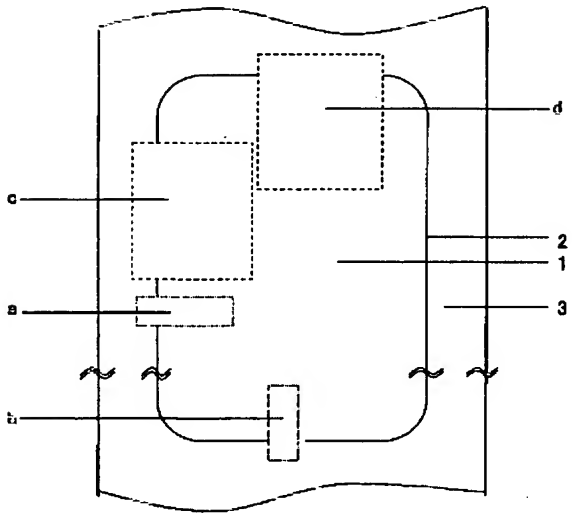
c：通気度測定用サンプル切り出し例

d：通気度測定用サンプル切り出し例

【図1】



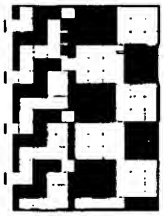
【図2】



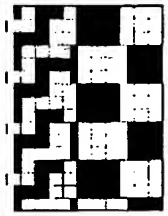
【図3】

【図4】

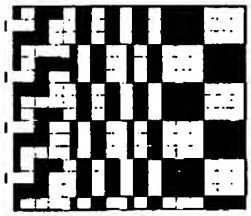
【図5】



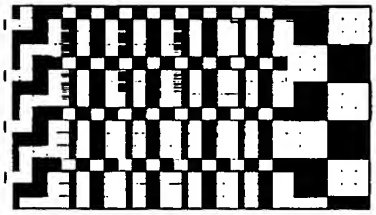
【図6】



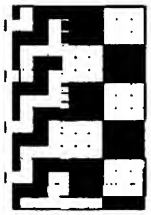
【図7】



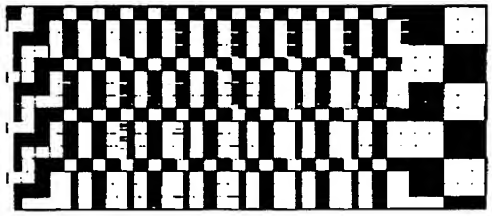
【図8】



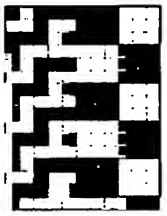
【図9】



【図10】



【図11】



【図12】